ena as the one in which the next important advances in general chemistry will be made,'' says Ostwald, who concluded his address thus, the aim of physical chemistry is to discover relations between the different branches of science and, instead of increasing the gap between them, to be an important factor in effecting their union.

In the afternoon a banquet was given to those present and in the evening the students held a 'Kommers.'

Thus was opened the finest laboratory for physical chemistry now in existence, it being the fourth in Germany alone. That of Landolt, in Berlin, is the oldest, while the laboratories of van't Hoff, in Berlin, and Nernst, in Göttingen, have scarcely two years of history. When we consider these facts, and, in addition, the number of places in which physical chemical investigations are in progress, especially in other laboratories in Germany, in France, Russia, Scandinavia, Austria, Japan, Holland, Great Britain, and America, we recognize that this branch of science has taken its place among the more important natural sciences.

And when we consider, further, that work of the character of that which is described as belonging to the 'Leipsic school' has been in progress for only a little more than a decade of years, we are impressed by what has already been accomplished, especially in the way of generalization.

It is to Ostwald that we are indebted for the *Zeitschrift* in which investigations could be published; for the experimental verification of the most important theories, and for the systematic presentation of the facts, in his monumental work —the *Lehrbuch*.

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*WIRELESS TELEGRAPHY.**

DURING the last few months the Solent has been the scene of some interesting experiments in wireless telegraphy. Under the direction of Signor Marconi two stations have been fitted up—one in Bournemouth, just opposite the end of the pier, and the other at Alum Bay, in the Isle of Wight—and between these places, which are $14\frac{1}{2}$ miles apart, regular communication has been maintained without the use of any intervening connecting wires. On occasion an even greater distance has been traversed, for with portable instruments temporarily set up on the cliffs at Swanage it has been found possible to speak with the station at Alum Bay—nearly 18 miles away. But Signor Marconi does not believe that this represents anything like the limits up to which his apparatus can be worked, and he is now making the necessary arrangements for exchanging signals with Cherbourg, a distance of some 60 miles.

The instruments employed at Bournemouth and at Alum Bay are alike in all essential respects. The only outward sign at either place is a tall mast, some 120 feet high, from which depends a metallic conductor. Sometimes this is a simple wire; at others a narrow strip of ordinary wire netting has been tried as affording more electrical capacity, but there does not appear to be any great difference in the results. Inside the stations the first piece of apparatus that catches the eye is an induction coil capable of giving a spark 8 or 10 inches long. This with an appropriate battery and a key to control the current constitutes the sending instrument. The discharge from the coil passes between two brass balls about $1\frac{1}{2}$ inches apart, thus giving rise to electro-magnetic waves which are radiated in all directions. One of the balls is connected with the external conductor already mentioned, the other is put to earth. Some

* From the London *Times*.

experimenters have employed a series of balls immersed in oil to generate the waves, but Marconi's experience is that the simpler arrangement he now employs is just as efficient. The receiving instruments consist of a coherer, a relay and a Morse printer. The coherer, the function of which is to detect the presence of the electric waves that travel through space from the sending station, is a short piece of glass tubing into which are sealed two silver pole-pieces. Between these there is a narrow space containing silver and nickel filings, and the whole is exhausted of air, not because a vacuum directly favors the sensitiveness of the instrument, but to prevent oxidation of the filings, which, of course, impairs their conductivity. These pole-pieces are included in an electrical circuit with the relay and a single cell, and in addition one of them is connected with the external conductor and the other with the earth. Normally the coherer does not conduct a current. But, by virtue of some action which is not yet fully understood, under the influence of an electric wave this condition is altered and a current enabled to pass through the filings between the pole-pieces. The armature of the relay is then attracted and the Morse printer or other suitable receiving instrument brought into action.

Thus the signal is begun, but it has also to be ended if the system is to be of practical use. The conductivity of the coherer does not, as might perhaps be expected at first sight, cease with the cessation of the electric wave that established it, but persists indefinitely so long as the instrument is not disturbed. The least mechanical shock or vibration, however, is sufficient to destroy it and to bring the coherer back to its original non-conducting condition. Hence Marconi provides on the relay circuit an electrical tapper, which by keeping the coherer in a state of constant vibration breaks down its conductivity as soon as it is established. The method of working is therefore as follows: If the operator at Bournemouth wishes to send a message to Alum Bay he connects his outside conductor with his induction coil, at the same time disconnecting it from the coherer. Then by means of the key he puts his coil into operation for long and short periods corresponding to the dashes and dots of the Morse code, thus exciting in the outside conductor groups of electric waves. Some of these fall upon the outside conductor at Alum Bay and convert the coherer there into a conductor; the relay circuit is immediately closed and the Morse instrument begins to print. Of course, during the transmission of one dash the circuit of the coherer is made and broken many times, but the printing instrument treats the quick succession of short currents as a single long one. The rate at which messages are sent in this way is not very great, but it is only fair to say that no efforts have been made to attain speed. The intention has rather been to demonstrate that signals can be sent with accuracy and certainty over a considerable distance without conducting wires.

A number of experiments have also been carried out between Alum Bay and a ship cruising about between the Isle of Wight and Swanage. In every case communication was easily maintained, whether the ship was moving forwards or backwards or swinging round. Nor was the working of the apparatus adversely affected by bad weather. On the contrary, it seemed to act most freely in fog, rain or wind, and was at its work on fine, clear, still days. These facts suggest that an early practical application of wireless telegraphy might be advantageously found in the establishment of communication between the shore and outlying lighthouses and light ships. No really satisfactory way of attaining this desirable end has so far been devised, and seeing that wireless telegraphy can be perfectly well

carried on in the climatic conditions which render other modes of communication difficult, if not impossible, the experiment is surely worth trying.

Other possible applications of this system of telegraphy might be enumerated, but it can scarcely hope to come into general use until one difficulty at least has been overcome, that is, to ensure that a message is received by the person to whom it is sent and by no other. Electric waves are thrown off in all directions from their generator, so that if a man sets up a station all his messages can be read by any one who cares to put up a precisely similar station within the limits to which the waves travel. Two principles may be employed to remove or lessen this inconvenience. Electric waves, like light waves, can be reflected and intercepted; hence a station could prevent the emission of waves in every direction but the one in which lay the station with which it wished to communicate, and thus reduce the possible eavesdroppers to those lying on the line along which the waves were directed. The other principle is that of syntony. Just as one tuning fork will vibrate in sympathy with another provided they are in tune with each other, and not otherwise, so one electric circuit will respond to the oscillations taking place in another, if they are in tune, but will be unaffected if they are not. Two stations therefore cannot telegraph across space to each other unless their apparatus is syntonized; hence by adopting differences of tuning a certain degree of secrecy may be arranged for. It remains to be seen whether the application of these two principles will suffice to provide a solution of the problem.

CURRENT NOTES ON METEOROLOGY.

PHYSIOLOGICAL EFFECTS OF HUMIDITY.

RUBNER and Von Lewaschew have recently been conducting laboratory experiments with a view to determining the effects of different degrees of atmospheric temperature and humidity on the human body (*Archiv. f. Hygiene*, Vol. XXIX). The individual on whom the experiments were made was placed in a closed chamber, into which air of varying known degrees of humidity was admitted. The separate tests lasted from four to eight hours each, and one hour before every test the same breakfast was eaten, while no food or drink was taken during the experiment. The body and the clothing were weighed before and after each trial, so that the amount of moisture given off or absorbed might be known. It was found that at low temperatures (57°–59°) dry air is pleasanter than moist; between 75° and 84° dry air seems cooler than moist when the change is made from one to the other. The last-named temperatures are easily borne if the air is dry. Visible perspiration was first noted at 84.2° and 22% relative humidity. Moist air (96% rel. humid.) made the temperature of 75.2° unbearable for a long time, and the experiment was possible only when there was no muscular movement whatever. At this temperature and humidity there was no considerable perspiration, although thirst was felt. Respiration decreased in dry air and increased in moist air. These experiments are interesting, but they do not give us the actual conditions that prevail in the outside air, as usually experienced by the human body. The movement of the air, which is a very important factor in its effects on the sensible temperature, and the varying amounts of heat lost by conduction, radiation and evaporation, according to the temperature and proximity of surrounding objects, are controls which do not come into play in the laboratory.

ELECTRIC SEARCH LIGHTS AS WEATHER SIGNALS.

THE *Monthly Weather Review* for February contains a note on the use of electric search